DOCUMENT RESUME

ED 448 724 IR 020 487

AUTHOR Jones, David; Stewart, Sharonn
TITLE The Case for Patterns in Online Learning.
PUB DATE 1999-10-00
NOTE 7p.; In: WebNet 99 World Conference on the WWW and Internet Proceedings (Honolulu, Hawaii, October 24-30, 1999); see IR 020 454.
PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Uses in Education; *Distance Education; *Educational Technology; Foreign Countries; Higher Education; Problems
IDENTIFIERS Central Queensland University (Australia); *Online Courses; *Pattern Analysis

ABSTRACT

This paper describes problems related to online learning at Central Queensland University (Australia) and suggests a process for the development and use of patterns in online learning as a possible step toward addressing these problems. The first section identifies the following problems with existing practice in online learning: the innovator/practitioner gap; the field gap; the newness of online learning; the relative unimportance of teaching; inflexible support systems; and limited quality. The second section lists requirements for a solution, including: reuse expertise and experience; provide training and raise awareness; encourage reflection and evaluation; and provide an adaptable, appropriate support system. The third section summarizes the history of patterns, and the fourth section defines the concept of patterns. The fifth section addresses writing a pattern. The sixth section discusses the mystical aspects of patterns, including generativity, piecemeal growth, and quality without a name (QWAN). The seventh section covers pattern languages, including theories, golden rules, and templates. The eighth section considers the possible demise of experts. The final section describes current work at CQU, including pattern mining, pattern workshops, pattern catalog, and constructive templates. (Contains 16 references.) (MES)

Reproductions supplied by EDRS are the best that can be made
from the original document.

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
G.H. Marks
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

The case for patterns in online learning

David Jones, Sharonn Stewart
Research Centre of Open and Distance Learning, Central Queensland University
Rockhampton, Australia, 4701
{d.jones|s.stewart}@cqu.edu.au

Abstract: The current practice of online learning, especially at an institutional level, can be characterised as being complex and expensive with limited sharing of ideas and experience leading to a large amount of reinvention. Patterns, simple and elegant explanations which capture solutions that have developed and evolved over time, are abstractions being used to increase reuse and quality in a variety of fields including architecture, software engineering, hypermedia, and teaching learning. This paper will introduce the concept of patterns, suggest that they offer advantages for online learning and describe how they are being used at Central Queensland University.

ED 448 724

Introduction

Central Queensland University (CQU) is a multi-campus regional institution with four branch, three interstate, and several international campuses. Fifty percent of CQU's students learn using a primarily print-based distance education approach. As with many other institutions CQU is increasing its use of online learning technologies for a variety of reasons both good and bad. In making widespread use of online learning CQU faces the same problems as other institutions. This paper describes what these problems are and suggests a process for the development and use of patterns in online learning as a possible step towards addressing these problems. In doing so the paper describes patterns and how they are being used at CQU.

The problems

The perceived need for the development and use of patterns for online learning (or possibly even traditional teaching and learning) is being driven by the observation of a number of problems with existing practice in online learning. These problems include

- **The innovator/practitioner gap.** Every year the literature includes hundreds, if not thousands, of good ideas associated with online learning. Most of these ideas are due to the work of a small group of innovators and researchers at individual institutions. At some institutions these ideas may come out of established centres for the support of and research into teaching and learning while at others they are the work of lone-ranging innovators. Few if any of these ideas find widespread use within their home institution and even less find widespread adoption amongst other institutions. Collis and Oliver (1999) report in their analysis of the papers submitted to EdMedia'99 that the majority of papers report on prototype development and evaluation with few ideas going beyond this stage. Additionally there is a long history of failed technology-based innovations (Reeves, 1999). There is a gap between the research and innovation in teaching and learning and the everyday practice.
- **The field gap.** The design and development of online learning requires input from professionals in a number of fields including computing, graphic design, instructional design and instructors. One of the problems with such group development activities is the limited understanding and appreciation of the disparate fields involved in the process. The gap in understanding and respect between the professionals of different fields can reduce the quality of the outcomes.
- **Online learning is new.** The new medium is different from traditional forms of teaching and learning, face-to-face and print-based distance education. It has different requirements and needs new methods to make most effective use of it. However, many if not most, applications of online learning continue to reuse methods and approaches from more traditional forms of teaching and learning. A contributing factor to this is that people are not aware of what can be done with the new medium and are falling back on what they know.
- **The relative unimportance of teaching.** Most Universities continue to be research focused with little but lip service being paid to the importance of teaching and learning. Evaluation of teaching and learning and

IR020487

BEST COPY AVAILABLE

subsequent rewards for innovative and effective practices is limited. Subsequently it is no surprise when teaching staff pay little heed to adopting new approaches to teaching and learning.

- **Inflexible support systems.** A combination of these factors along with the complexity of online learning leads to the development of large support structures and procedures to support and implement online learning. Most of these structures and procedures, like those associated with institutionalised print-based distance education, are inflexible and cannot adapt to changes in the environment or to the requirements of individual courses, staff or students.
- **Limited quality.** All these factors contribute to most online learning being limited in quality. Surveys of websites for teaching and learning (LaRose &Whitten, 1999; Mioduser, Nachmias, Oren & Lahav, 1999) show that the majority of sites make less than effective use of the medium.

Requirements for a Solution

The overall aim of a solution to these problems is to increase the quality of online learning at an institution. To achieve this it is suggested that such a solution will have to

- **Reuse expertise and experience.** It should capture and enable the reuse of the expertise of researchers made available in the literature and of the current practice of the innovators at an institution. It should enable, improve and reward the continued innovation of the innovators.
- **Provide training and raise awareness.** Provide a forum where people from all the fields involved in the development and implementation of online teaching and learning can discuss ideas, learn about the new medium and become aware of the requirements of each field.
- **Encourage reflection and evaluation.** An essential component of any solution should be to encourage people to reflect and evaluate the quality of teaching and learning and reward people for participation in the process.
- **Provide an adaptable, appropriate support system.** The characteristics of online mean that a support system will be required. However, the support system should be able to adapt to changes in technology and to the individual requirements of courses, staff and students.

A possible solution is to provide a common language which enables collaboration and sharing of ideas. The provision of a common language facilitates the process of understanding and may decrease the amount of reinvention. If everyone involved is speaking the same language it facilitates the process of understanding. However, providing a common language is not enough. An environment which emphasises the discovery, collaboration and reflection in which to use this language is also required. We suggest that 'patterns' and their appropriate application may be one possible answer.

History of patterns

Christopher Alexander appears to have first proposed the idea of patterns for application in the field of architecture in the late 60s early 70s. In the late 80s early 90s programmers struggling with object oriented programming discovered the concept of design patterns and adopted them for use in designing object-oriented programming systems. The use of patterns has since exploded into a wide range of different fields including: pedagogy (Erickson & Leidig 1997; Manns, Sharp, Prieto, & McLaughlin 1998); analysis (Fernandez 1998); hypermedia (Nanard, Nanard & Kahn, 1998; Rossi, Garrido & Carvalho 1996); structuring organisations; re-engineering systems; project planning; and a range of other different areas.

What is a pattern

A pattern is "a generic approach to solving a particular problem that can be tailored to specific cases. Properly used, they can save time and improve quality" (Fernandez 1998). As Alexander (1977) puts it: "Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice". At a simple level, a pattern is a way to record the knowledge and experience of experts. A way of reusing best practice and taking into account the lessons others have already learned.

The use of patterns provide a number of benefits including making it easier to reuse successful designs, make proven techniques more accessible to developers, enable choice between alternatives, and improve the documentation and maintenance of existing systems (Gamma, Helm, Johnson and Vlissides, 1994).

In practice, a particular pattern format is used to describe the decisions, alternatives and the trade-offs which contributed to the development of the pattern. The use of consistent format for the description of patterns makes it easier to learn, compare and use patterns (Gamma, Helm, Johnson and Vlissides, 1994). There are a number of common formats which have been used to describe patterns in different applications.

Writing a pattern

Writing a pattern is a difficult, creative, and usually collaborative process. A major contributor to the difficulty of writing a pattern is extracting and abstracting expert knowledge and experience from a situation. Additionally, actually achieving the qualities of a well written pattern can be extremely difficult. The process usually starts with pattern mining, that is, searching for patterns to document. This could be undertaken by searching the literature, attending conferences, or reflecting upon personal practice to abstract practices which work. The pattern author is not necessarily the original innovator, although that can be the case.

Patterns are usually developed in a writers workshop, a practice adapted from creative writing. Writers workshops are a collaborative way of producing and improving upon patterns. A writers workshop is a positive, friendly and collaborative group process led by a moderator with the author actively participating at designated times. In short, the group forms a circle, reads the pattern, offers positive comments then suggestions for improvement, finally the author asks for clarification.

At some point in the future the author rewrites the pattern based on the feedback from the writers workshop. Once a pattern has been identified, written and moved through a writers workshop it is then stored in a pattern catalogue. A pattern catalogue is a collection of good patterns.

Typically, at least in programming and a number of other fields, conferences are held where writers workshops are conducted. Pattern Languages of Programming (PLoP) design conferences are one of the key areas where programming design patterns are produced. There is non-anonymous review and careful editing. PLoP conferences are held around the world annually EuroPLoP (http://www.argo.be/europlop), PLoP USA (http://st-www.cs.uiuc.edu/~plop/plop99/), Chilli PloP (http://www.ages.com/patterns/chilliplop). Additionally, at regular intervals PLoP conferences produce edited books of the best patterns from conferences (Coplien and Schmidt 1995; Vlissides, Coplien & Kerth, 1996).

The mystical aspects of patterns

It could be argued that patterns and pattern workshops are basically a collaborative process for producing a number of papers which follow a fixed format. Patterns, particularly when they are grouped together in a pattern language (described below), are intended to be much more. Three of the aspects of patterns which make it more than a specially formatted paper are: generativity, piecemeal growth, and the quality without a name (QWAN).

Generativity

Patterns are not simply descriptions of good systems, they are meant to generate new systems. When a pattern is applied the system moves from one particular context to a new context. Ideally, by the continual applications of related and well designed patterns a living structure is generated capable of dynamically adapting to changing needs and demands. Using an analogy from architecture, patterns are designed so that rather than building only a single room, it can be added to and generate a new environment which can be adapted to different means. The intent is that as a number of small patterns are applied, the well designed pattern language will move the user to a larger solution addressing larger problems.

Piecemeal growth

Piecemeal growth is the assumption that every environment whether it be for a building, a learning environment or a computer program is continually changing. Piecemeal growth is the opposite of traditional practice, particularly in architecture, which relies on design for replacement. For example a building is created with one purpose in mind. Twenty years later when there are more people it is torn down and replaced with a different building which better suits the current context.

Piecemeal growth is an approach which emphasises design for repair, not replacement. As the environment changes new patterns are selected and applied continually moving the design from one context to another, replacing older designs,with more appropriate designs. An example of this is the story about the most beautiful house in the world (Rybczynski 1990). Rybczynski, a professor of architecture, sets out to build a dwelling in which to house the construction of a boat. However, as building proceeds the environment changes and the purpose of the dwelling changes. Eventually, rather than using it to build a boat the structure becomes a place to live. This is an example of piecemeal growth, continually applying patterns to achieve something that you probably would not have predicted in the beginning.

Quality without a name (QWAN)

The QWAN of a pattern is the incommunicable beauty that gives immeasurable value to the structure. Again using the architecture analogy QWAN is that experience of walking into a room that is well designed and just 'feels' right. The quality is without a name because it is meant to include concepts such as beauty and order, recursive centres of symmetry and balance, life and wholeness, resilience, adaptability, durability, comfort, satisfaction, and resonance (emotionally and cognitively). These concepts form QWAN as described by Alexander (1979) for architecture. QWAN for online learning may include some of these qualities but may also require more specialised qualities.

QWAN is one of the three foundation concepts for the pattern based approach to architecture proposed by Alexander (1979). The other two foundation concepts are "the gate" and "the timeless way". In summary, "the gate" (a pattern language, described below) provides the path by which you can use "the timeless way" (piecemeal growth)' to achieve QWAN.

Pattern languages

A pattern language is more than just a pattern catalogue (a collection of patterns). It is a cohesive collection of patterns and rules (guidance) on how to combine these patterns into a style or philosophy that enables you to achieve the QWAN. A pattern language is not meant to be a simple to follow prescription or recipe. Instead it is a language which enables an infinite variety of solutions limited only by the creativity and ability of the user of the pattern language. A good pattern language guides the designer toward useful or 'good' architectures (Coplien 1996).

Theories, Golden Rules, Patterns and Templates

Nanard, Nanard and Kahn (1998) talk about the relationship between golden rules, patterns and constructive templates in relation to using design patterns in hypermedia. In designing a hypermedia application there are collections of patterns that can be used which have been influenced by the golden rules. For example short term memory effectively holds seven plus or minus two entities, this is a golden rule in interface design. Therefore when interfaces are designed they should only have seven plus or minus two choices on screen.

Constructive templates are approaches or ways in which patterns could be implemented. Remember patterns are meant to be abstract whereas constructive templates are more descriptive enabling patterns to be put into practice. Typically a pattern may be related to numerous constructive templates due to the variability of a good pattern.

The authors would like to expand the Nanard, Nanard and Kahn (1998) model to include a higher principle relating to the education field, that is the philosophical stance that the educator brings to the entire experience. This is the set of beliefs the educator has about how teaching and learning occur, for example the constructivist

philosophy. It is suggested that the beliefs an educator has will inform the golden rules which in turn inform the patterns that are implemented using the constructive templates.

The demise of experts

A misconception that arises when discussing the application of patterns is the possible demise of experts. If there is a pattern catalogue available to novices which describes how to design a good system, surely the experts will no longer be necessary? The reason this may not occur is that applying patterns requires a great deal of knowledge and creativity. To create and apply patterns in online learning a knowledge of the context of application is required in addition to a familiarity with the environment and the implications of actions. For example a knowledge about the students' situation and the content is essential.

There also needs to be an understanding of patterns and creativity in their application and combination. The application of one pattern will not solve all problems, by their very essence they are meant to encapsulate one issue. Further, continually creating patterns requires a community of experts contributing to and evaluating patterns. Therefore patterns are not a way to eradicate professionals, rather they "channel creativity; they neither replace nor constrain it" (Coplien 1996). Importantly, once experts start using pattern languages they are not straight-jacketed into a regime. Patterns and pattern languages are designed such that there is enough variability that they can be applied creatively in an infinite number of ways.

Patterns, online learning and current work

We are currently setting up a patterns group at CQU which hopes to develop a pattern catalogue for online learning. It is hoped that the pattern catalogue and the process used to construct it will develop into an approach for implementing and evaluating online learning which will address the problems outlined earlier. The process we are using includes the following steps

- **Pattern Mining.** This includes sifting through the existing literature and also practice at CQU for examples of good practice. Pattern mining helps bridge the gap between research and practice. By mining the literature we are finally attempting to put into practice many of the good ideas which have been discussed in recent years.
- **Pattern Workshops.** Over a period of six months individuals from a number of fields including: instructional design, graphic design, web masters and instructors will come together in a number of pattern workshops. Each person will be responsible for creating patterns from the results of the pattern mining process. The collaborative, group development process which makes up a patterns workshop will provide an opportunity to share knowledge, experience and ideas amongst a varied group of staff. Participation in this process is a form of professional development and will help expand the participant's awareness of the ideas of other areas and their understanding of online learning.
- **Pattern Catalogue.** The patterns which are produced by the patterns workshops will be placed into a Web-based pattern catalogue which offers a number of different ways of searching for patterns. Being able to easily search and view patterns may make it easier for other staff to identify good practice applicable in their situation. Additionally, the patterns produced by this process will be published in a book which will contribute publications which count towards promotion and provides extra incentive to the workshop participants.
- **Constructive templates** (Nanard, Nanard & Kahn, 1998). To increase the ease by which these patterns can be adopted by other staff a number of the patterns will be implemented as constructive templates into a web development tool currently used by the Faculty of Informatics and Communication (Jones, 1999).

In the longer term it is hoped that pattern mining and construction can become an entrenched part of the teaching and learning practice at Central Queensland University.

Conclusion

Patterns are a basis for codifying and using innovation. Creating patterns requires a collaborative process which emphasises the continual reflection and generation of new patterns based on experience. We are suggesting that the incorporation of a pattern generation process into standard practice will address many of the problems associated with online learning. Eventually, when a pattern language for online learning has been produced, it may

be possible to generate an online learning experience which demonstrates the quality without a name.

References

Alexander, C., Ishikawa, S., Silverstein, M. (1977) *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press.

Alexander, C. (1979) *The Timeless Way of Building*. Oxford University Press.

Collis, B., Oliver, R. (1999) Preface. *Proceedings of EdMedia'99*, Seattle, Washington, pp 5-6.

Coplien, J. (1996) Software Design Patterns: Common Questions and Answers. ftp://st.cs.uiuc.edu/pub/patterns/papers/PatQandA.ps

Coplien, J., Schmidt, D. (1995) *Pattern Languages of Program Design* Addison Wesley, Reading, Massachusetts.

Erickson, C., Leidig, P. (1997) A pedagogical pattern for bringing service into the curriculum via the web. *ACM SIGCSE Bulletin*, Vol. 29, No. 3, pp 54-56

Fernandez, E.B. (1998) Building systems using analysis patterns. *Proceedings of the Third International Workshop on Software Architecture*, pp 37-40.

Gamma, E., Helm, R., Johnson, R., Vlissides, J. (1994) *Design Patterns: Elements of Reusable Object-Oriented Software* Addison Wesley, Reading, Massachusetts.

Jones, D. (1999) Webfuse: An Integrated, Eclectic Web Authoring Tool. to appear *Proceedings of EdMedia'99*

LaRose, R., Whitten, P. (1999) Building Web Courses with Instructional Immediacy. *Proceedings of EdMedia'99*, Seattle, Washington, pp 1436-1437.

Manns, M.L., Sharp, H., Prieto, M., McLaughlin, P. (1998) Capturing Successful Practices in OT Education and Training. *Journal of Object Oriented Programming* Vol. 11, No. 1, pp 29-34.

Mioduser, D., Nachmias, R., Oren, A., Lahav, O. (1999) Web-Based Learning Environments (WBLE): Current State and Emerging Trends. *Proceedings of EdMedia'99*, Seattle, Washington, pp 753-758

Nanard, M., Nanard, J., Kahn, P. (1998) Pushing reuse in hypermedia design: golden rules, design patterns and constructive templates. *Proceedings of the 9th ACM Conference on Hypertext and Hypermedia* pp 11-20.

Reeves, T. (1999) A Research Agenda for Interactive Learning in the New Millennium. *Proceedings of EdMedia'99*, Seattle, Washington, pp 15-20.

Rybczynski, W. (1990) *Most Beautiful House in the World*. Viking Press

Vlissides, J., Coplien, J., Kerth, N. (1996) *Pattern Languages of Program Design 2*. Addison Wesley, Reading, Massachusetts.